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AN INVESTIGATION INTO CONSUMER BEHAVIOUR TOWARDS E-WASTE DISPOSAL PRACTICES IN INDIA

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ABSTRACT

India currently generates 2 million metric tonnes (MT) of e-waste every year which is expected to rise to 5.2 million MT per annum by 2020 (ASSOCHAM, 2018). Over 95% of e-waste is routed to unorganized sector. Consumer awareness about e-waste and e-waste disposal plays a crucial role in routing it to organized sector. This study investigates about e-waste awareness level and the current e-waste disposal practices of consumers in India. It also evaluates role of incentives in driving consumer behavior, reasons for discarding electronics etc. and suggest measure to improve collection efficiency of the organized sector.Survey method is employed to get insights about consumer behavior towards E-waste disposal practices. SPSS is used for descriptive statistics of data collected.Findings reveal low level of awareness among people related to e-waste and e-waste rules. Data security is one of the most important factors for e-waste disposal. Analysis reveals most of the respondents agree that convenience of e-waste collection influence their E-waste disposal behaviour.

KEY WORDS ***e-waste, consumer awareness, e-waste rules, incentives. e-waste disposal***

1. INTRODUCTION

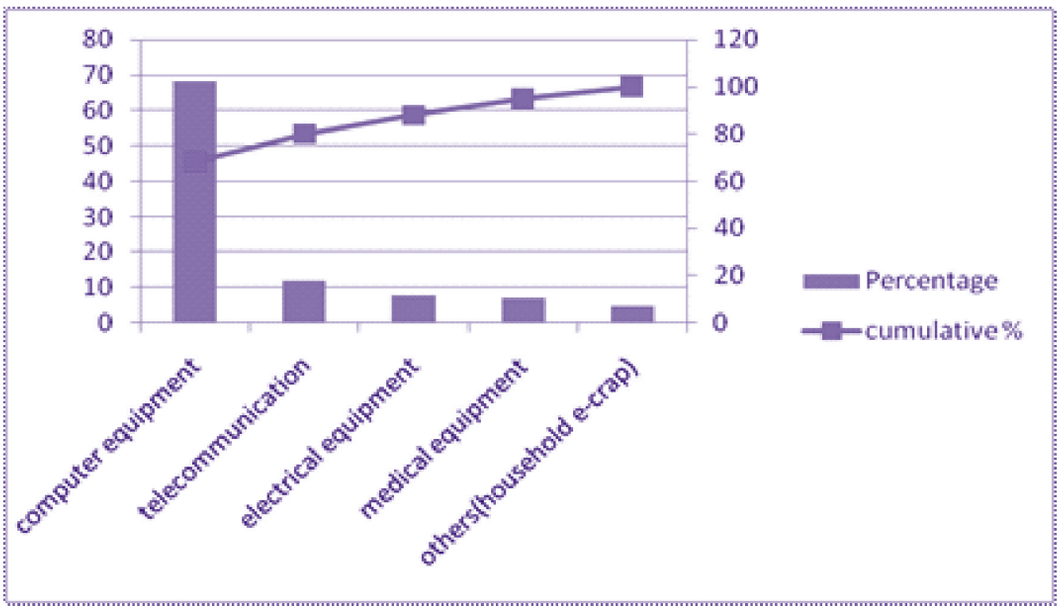
Electronic gadgets have become an essential part of our lives providing us with more ease, security, and faster acquisition and exchange of information. Contrarily, it has led to unrestrained resource consumption and startling E-waste generation.The average lifespan of most electronic gadgets has been constantly reducing as most of the companies design their electronics for planned obsolescence. Affordability of these gadgets has also increased the consumerism. Most of the customers are unaware about proper e-waste disposal methods which, unfortunately, means that most of it ends up in landfills via unorganized sector. Increasing quantum of e-waste, and its unsafe treatment and disposal by informal units through open incineration or landfilling leads to severe impact on health and environment. These practices acts as a barrier towards achievement of the Sustainable Development Goals (SDGs) (Baldé et al., 2017) (UN, 2015).Environmental sound management(ESM) of e-waste will contribute towards the achievement of several goals of the 2030 Agenda for Sustainable Development as shown in Table 1.

Table 1: E-waste management and SDGs

Goal	How e-waste management will address these goals
Goal 6 - Clean Water and Sanitation Goal 11 - Sustainable Cities and Communities Goal 12 - Responsible Consumption and Production Goal 14- Life Below Water	ESM of e -waste will prevent water, air pollution as many toxic elements and acids are released during improper E-waste recycling causing soil and water contamination in the surrounding areas (Toxicslink, 2014) About 30% of gold produced, 14% of the silver produced and 30% of copper produced globally is being used in the production of Electronics (Schluep et al., 2009) (IndigoEdge, 2013). Hence, e-waste recycling will lead to urban mining and circular economy(Chaudhary & Vrat, 2018). The manufacturing of electronics results in 30-75% of

	the carbon footprint. If 1 million computers are recycled it can cut annual GHG emissions by the same amount as emitted by over 17000 cars (EPA, 2011) (Electronics TakeBack Coalition, 2016).
Goal 3 - Good Health and Well-Being of People Goal 8 - Decent Work and Economic Growth	Most of the e -waste is being handled by unorganized sector in very unsafe working conditions. Around 0.4 - 0.5 million children are working in unorganized e-waste industry (Kalra,2004) (ASSOCHAM, 2018). Routing of e -waste to formal sector will prevent health impacts on informal industry workers and also prevent child labor. E -waste management industry can provide green jobs, Recycling of material will boost up economic growth of the industry as well as country.

As per an ASSOCHAM report of 2014, the major portion of E-waste generated consists of computers, followed by telecommunication equipment. Figure 1 shows the Pareto analysis of E-waste categories in India. It implies that 80% of the E-waste is generated through computers and telecommunication devices like mobile phones; hence, these must be given immediate attention. It shows most of the e-waste are PCs, laptops and cellphones. In India mobile subscribers' base is 1003.49 million and around 60 million new subscribers are added every year (Trak, 2017). Hence, consumer awareness is crucial to handle the current and forecasted e-waste.



Source: (ASSOCHAM, 2014)

Figure 1: Pareto Chart of E-waste in India

As per ASSOCHAM NEC joint study report on e-waste, India is one of the major generator of e-waste accounting to 2 million TPA. In 2016, only 20% i.e. 8.9 MT of total e-waste was documented to be collected and recycled (Baldé et al, 2015)(ASSOCHAM, 2018). Over 95% of e-waste generated is managed by the unorganised sector and scrap dealers, who typically dismantle the disposed products instead of recycling it (Chaudhary & Vrat, 2017). The major barriers to effective e-waste management are lack of adequate infrastructure, negligent regulations, consumer awareness.Unregulated accumulation and recycling of e-waste has become immediate as well as long term concern resulting in major environmental and health hazards (Clean India Journal, 2013) (IndigoEdge, 2013). Most of the equipment are stockpiledin homes, offices, and repair shops as owners lack knowledge about disposal options. Consumers are also concerned about residual value of the e-waste. Such issues are major hurdles towards collectionof e-waste in India. Knowledge about where to discard e-waste is lacking right from the consumer to the final disposer(V Ranganathan, 2018).Moreover, out of aware consumers only 2% of individuals think of the impact on environment while disposing off their old electrical and electronic equipment (IRGSSA, 2010).

In most of the developed nations such as Switzerland, consumers pay Advance Recovery Fee(ARF) which covers the cost of managing e-waste. On the other hand, in India consumers get paid or incentivized for their e-waste by scrap dealers ,mostly informal waste collectors (Sinha, 2004) (Schluep & Muller, 2013). This prompts consumers to dispose their e-waste via informal channel. This is one of the reason that e-waste management policy has not succeeded in tackling the e-waste problem. Lack of infrastructure and expertise are barriers to handle e-waste effectively. There is a wide scope of generating multi-crore business based on e-waste treatment and e-waste recycling as e-waste is also mounting at a rapid rate.E-waste management can be linked to ambitious “Swatch Bharat Abhiyaan” initiated by the Prime Minister of India.

This paper aims to investigate about e-waste awareness level of consumers and preferred methods of e-waste disposal by consumers by using a questionnaire technique. The purpose of survey is to find out the current e-waste disposal practices of consumers, role of incentives in driving consumer behavior, reasons for discarding electronics, and find out the factors that motivate consumers to adopt environment friendly way. Analysis of responses will help to find out methods to increase collection efficiency of e-waste.The main challenge towards establishing an effective Reverse Supply Chain of E-waste is to initiate the e-waste flows from consumer end via a proper routei.e. acquiring e-waste from consumers.

Awareness ensures that consumers participate in the process of RSCM. Still there are very little efforts by the producers to create awareness. Lack of awareness also leads to inefficient product use, lack of engagement with reuse and recycling from consumer end. Companies mainly focus on forward flow of goods as there is little awareness about reverse supply chain of e-waste.

It can include a variety of activities depending on whether the goods are returned from a customer (end user). Probably it is important to create few mandates to create awareness using campaigns. To investigate about the awareness level and preferred methods of e-waste disposal by consumers a questionnaire analysis was done using Statistical Package for the Social Sciences (SPSS).

1.1 Objectives

This study attempts to achieve following research objectives:

1. To analyze current e-waste awareness level among consumers.
2. To understand role of incentives in influencing e-waste disposal.
3. To provide recommendations to improve e-waste collection efficiency based on consumers' suggestions and opinions.

2. RESEARCH METHODOLOGY

2.1 Survey Method Using A Structured Questionnaire

Survey method acts as a source for the collection of primary data from different and scattered groups. According to Bogardus, “a questionnaire consists of a list of the questions put in a definite order, and sending them to the respondents. This technique helps in the collection of reliable and dependable data. It secures the standardized results that can be tabulated and also treated statistically.”

Hence, in this research, questionnaire was formulated to get insights about consumer behavior towards E-waste disposal practices. Questionnaire consisted of closed ended questions and Likert scale was employed. Non-random sampling method was used. Google forms was used to create the questionnaire, and then it was circulated using electronic media i.e. through emails, social networking website.

Statistical Package for the Social Sciences (SPSS) is one of the most widely used statistical packages, which can execute highly complex data manipulation and analysis with simple instructions. It can import data from almost any type of file and generate tabulated reports, charts, and plots of distributions and trends, descriptive statistics, and complex statistical analysis like Bi-variate analysis, Linear regression, Factor analysis, Cluster analysis, R extension, etc. (Argyrous, 2005)

In this research, SPSS is used for Descriptive statistics of data collected using Survey method.

This chapter is intended to analyze consumers' behavior towards E-waste. The questionnaire was framed considering various variables impacting E-waste collection and disposal. Data collection has been done using a structured questionnaire. Cronbach's alpha score of reliability test is 0.77. Questionnaire was prepared using Google forms and was circulated using electronic media. Hence, non-probabilistic sampling technique was used. The data collected was analyzed using Statistical Package for the Social Sciences (SPSS).

The questionnaire consisted of eight sections. Section A consisted of demographic questions asking for the participants'

name, age, location, gender, education, and occupation. Section B to Section G consisted of questions related to E-waste awareness, E-waste disposal practices, reasons for buying new products, and different methods to improve E-waste collection efficiency and E-waste awareness among masses. Section H consisted of one open-ended question where consumers put forward their suggestions to improve E-waste collection. Questionnaire used is attached as Annexure A1.

To understand the awareness level; questions related to E-waste rules, E-waste recyclers, etc. were asked using five point Likert scale {where 5 = Fully aware; 4 = Quite aware; 3 = Moderately aware; 2 = Somewhat aware; 1 = Not at all aware}. To analyze the frequency and use of major disposal methods, five point Likert scale was used {where 5 = almost always; 4 = frequently; 3 = sometimes; 2 = occasionally; 1 = hardly ever}. To understand how important are various factors like ease of disposal, door to door collection, etc. are in encouraging and promoting the environmentally sound disposal of E-waste of also Likert scale was used {where 5 = Very important; 4 = Moderately important; 3 = Neutral; 2 = Low importance; 1 = Not at all important}. To find out effectiveness of various alternatives to improve collection efficiency and awareness level, Likert scale was used {5 = Very effective, 4 = Effective, 3 = Average, 2 = Ineffective, 1 = Very Ineffective}. Further, descriptive statistics have been used to analyze the data.

2.2 Survey Participants

The data came from 209 respondents throughout India. Sample size was considered sufficient considering 90% confidence level. The respondents belonged to the age group ranging from 18 to over 65 years.

3. ANALYSIS OF RESPONSES OF CONSUMERS USING STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES (SPSS) SOFTWARE

Section A attempts to obtain demographic information of respondents. Analysis reveals that out of 209 respondents; 65% were Male and 35% were Female. A greater percentage, 59.1% belonged to age group of 25-34 years, 21% respondents belonged from 18-24 years, 15.4% belong to 35-44 years, 2.9% belong to 44-54 years, and 1.9% to 55-54 years of age group as shown in Figure 2. Responses of 25-34 years age group provides information which is important, as they are young working class, more of technology-oriented, and represent greater Indian population. Demographic analysis reveals most of the respondents belong to service class and students (80%) as shown in Figure 3.Most of the respondents are active users of electronics equipment and hence, can provide pertinent information.

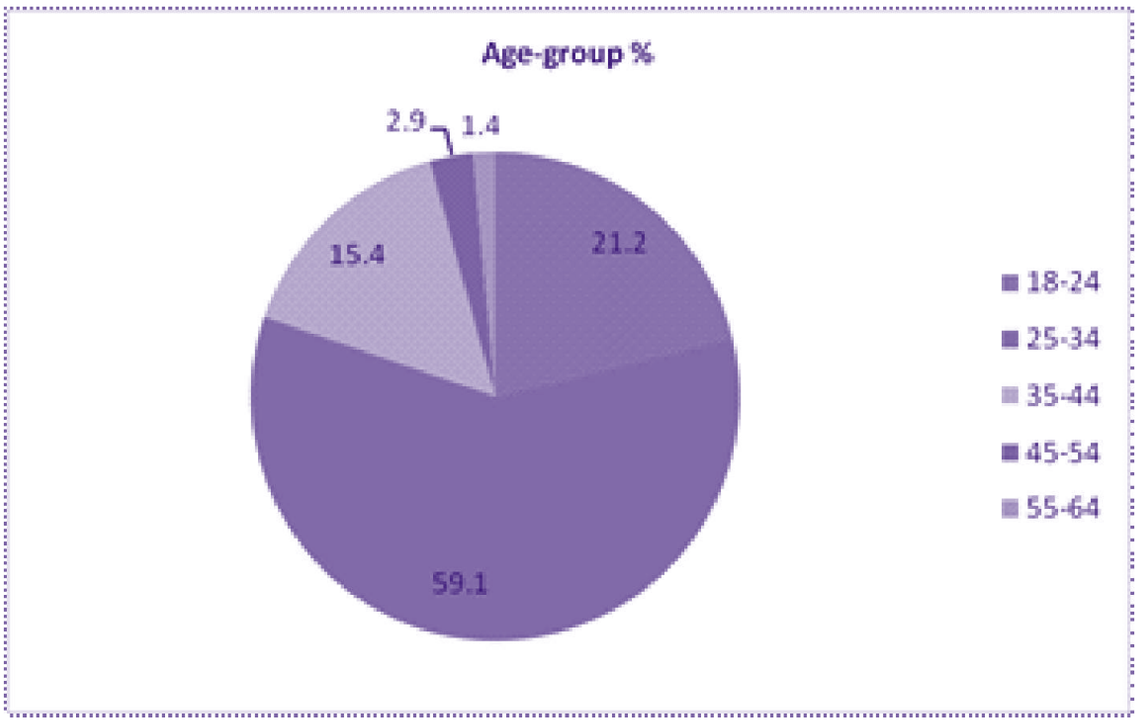


Figure 2: Age groups of Respondents

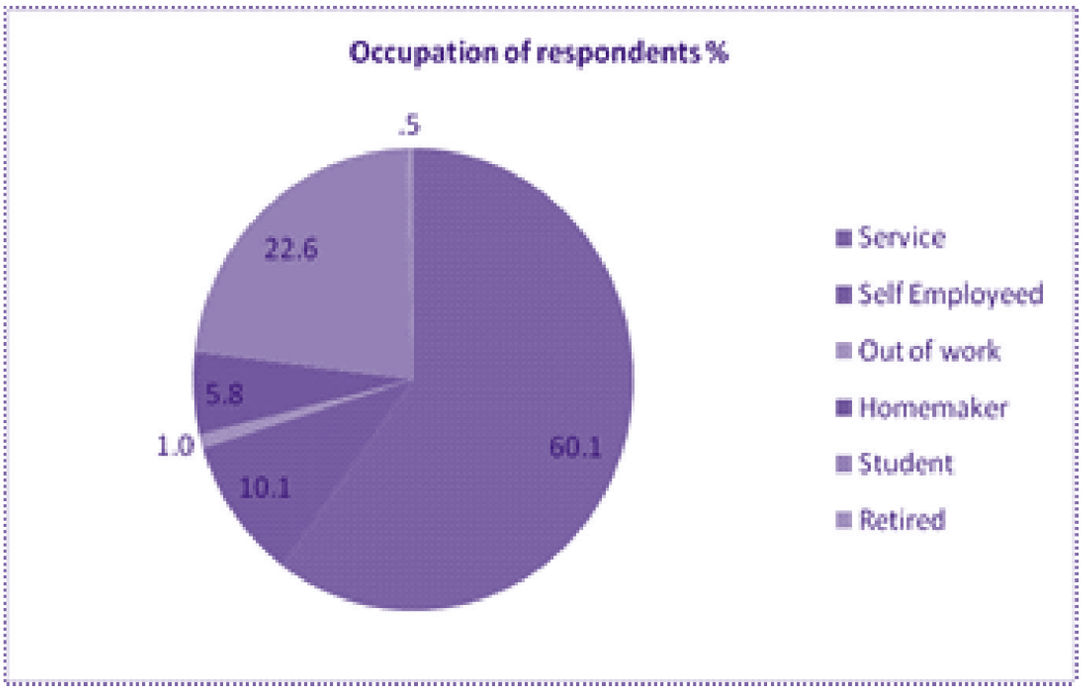


Figure 3: Occupation of Respondents

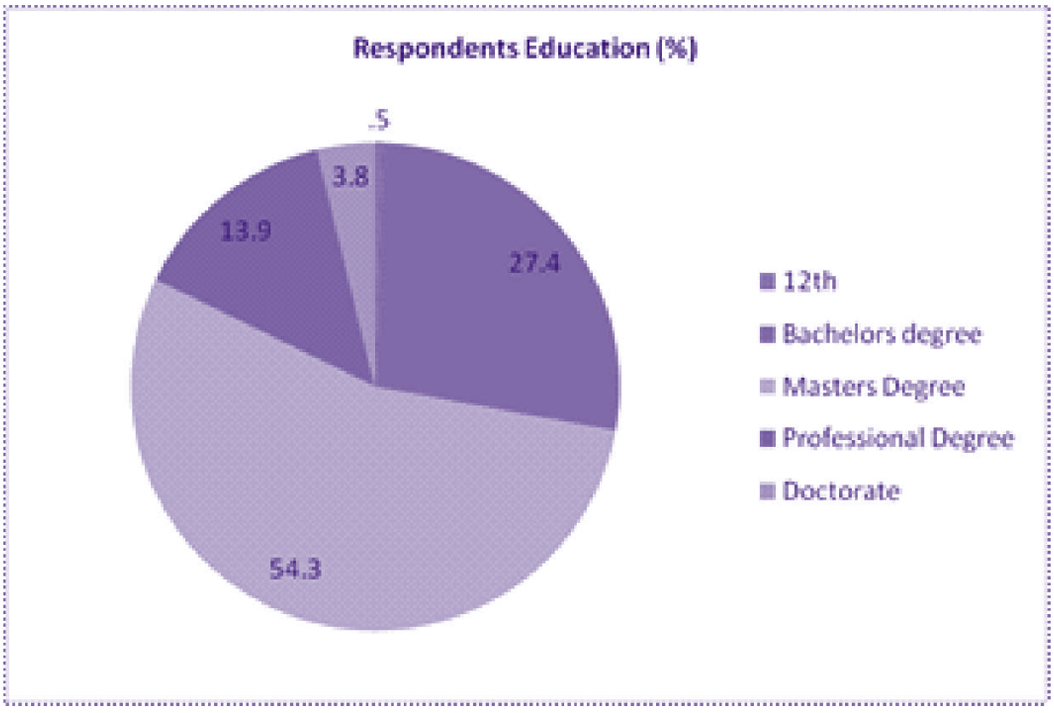


Figure 4: Education of Respondents

Figure 4 shows around 54% of respondents possess Master Degree and around 27% are Under Graduates. This analysis reveals most of the respondents are well educated.

Section B of questionnaire consists of Questions related to E-waste awareness. The analysis reveals only 9.6% of respondents are fully aware about severe environmental issues related with E-waste dumping via unorganized sector (Figure 5). Also, only 6.7% are fully aware about hazardous nature of E-waste and about 3.8% have knowledge of E-waste regulations as shown in Figure 6. Data related to awareness reveals that consumers lack awareness related to E-waste issues and hazardous nature of E-waste. Analysis also reveals only 5.3% are fully aware about E-waste recycling concepts and benefits.

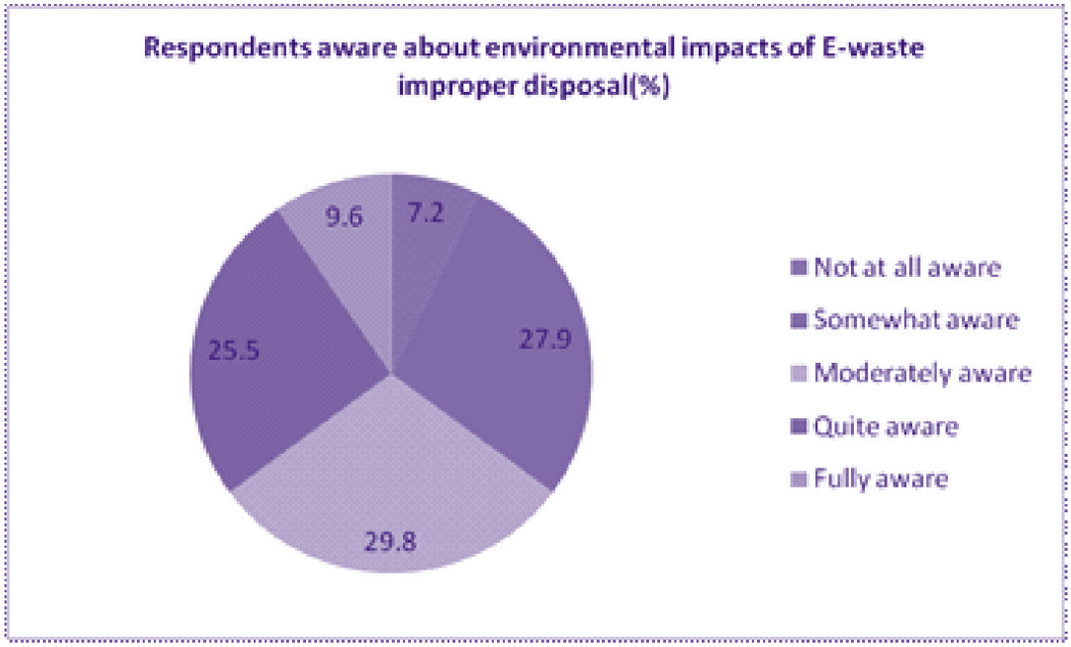


Figure 5: Awareness level of Respondents

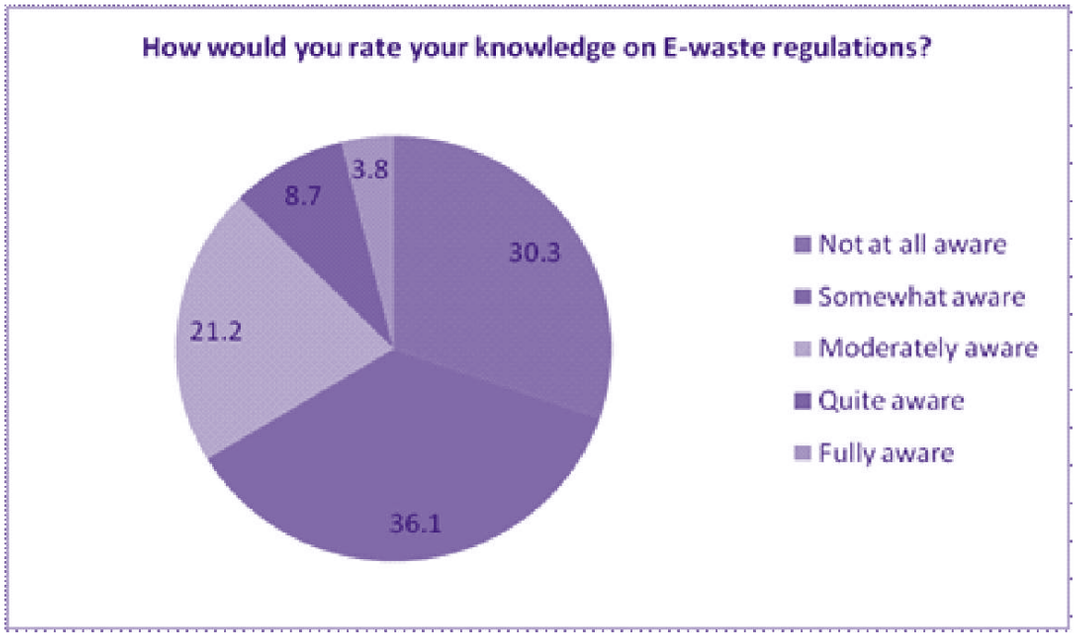


Figure 6: Respondents' awareness related to E-waste regulations

Section C consists of questions related to role of incentives in driving consumer E-waste disposal practices. Data analysis reveals around 53% of respondents agree to the fact that incentives paid by organized sector players are very meager. 60% agree to the fact that poor incentives paid by organized players lead to E-waste disposal via unorganized sector (Kabadiwallas) as shown in Figure 7.

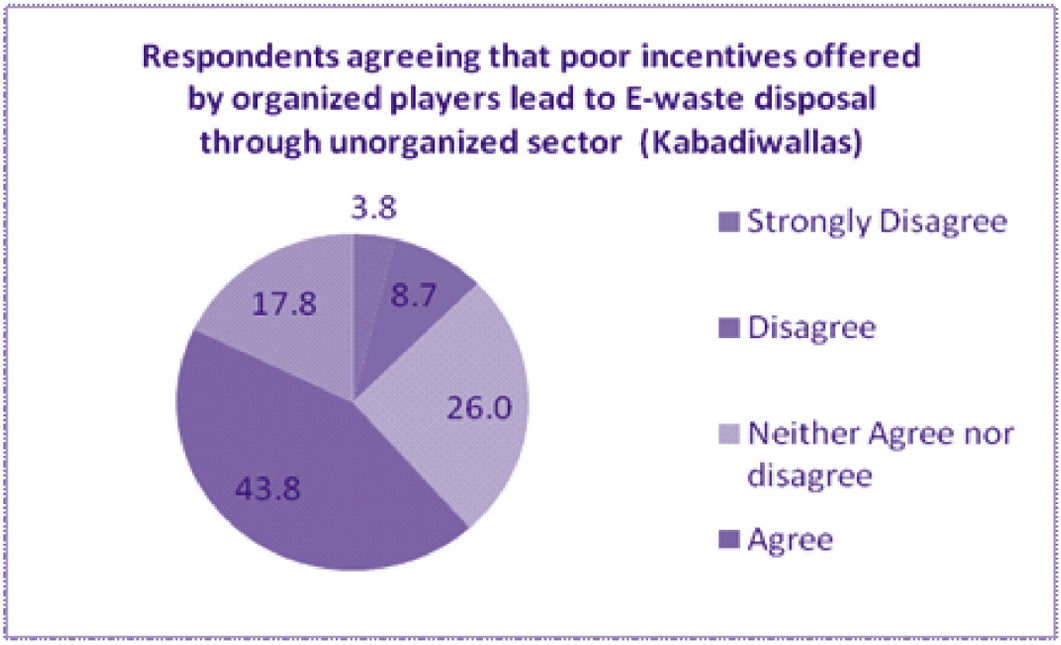


Figure 7: Role of incentives in driving consumer behavior

Section D corresponds to questions related to reasons of discarding Electronics products. Analysis reveals that around 74% respondents agree that product obsolescence or short life cycle of electronics products is main reason of discarding electronics (Figure 8). Analysis also reveals some interesting facts such as 62% of the respondents agree that craving for new versions is reason for discarding their electronic products. 55% agreed that competition in peer group is the reason for discarding old electronics products.

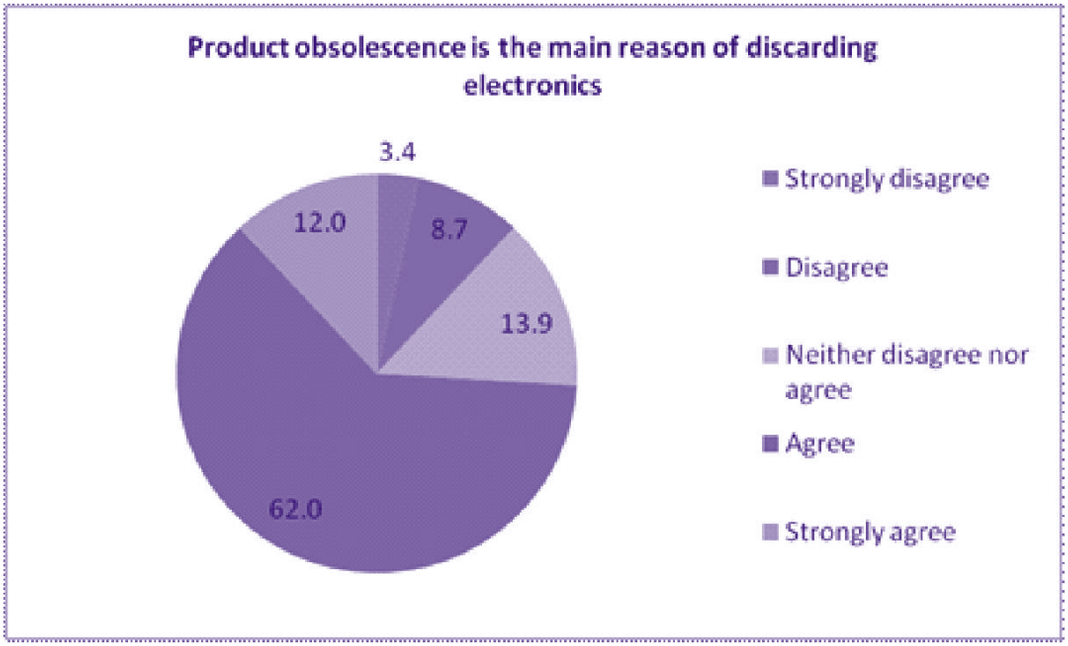


Figure 8: Product obsolescence as a reason for discarding electronics

This analysis reveals that young generation gets fascinated by new products available in the markets. Young generation is easily influenced by electronic products possessed by their friends and collegues and hence, this drives their electronics buying behavior.

Section E consists of questions related to frequency of various alternative modes of E-waste disposal adopted by consumers. Analysis reveals, as of now e-plaform is rarely used by consumer for disposing E-waste (Figure 9). Figure 10 indicates that consumers rarely sell their electronic products to retail stores. Analysisindicates that consumers occasionally donate their old electronics for reuse as 50% responded they hardly donated their E-waste and 20% said they do it occassionally.

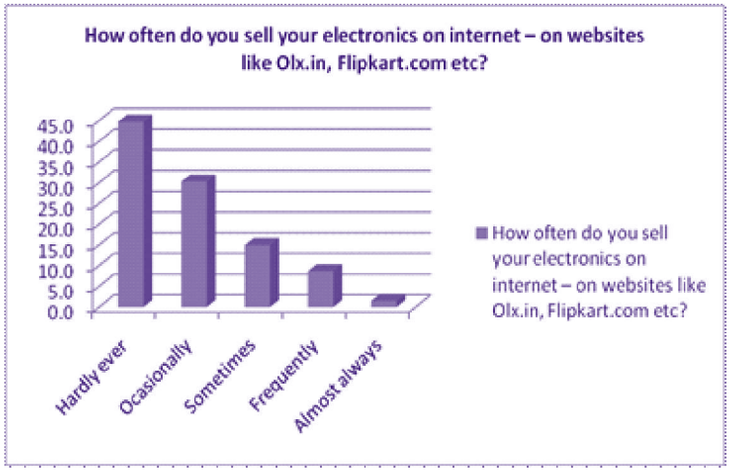


Figure 9: Frequency of disposing E-waste via E-platform

Figure 10: Frequency of disposing E-waste by selling them to retail stores

Analysis reveals that around 60% of the respondents store their old electronics in their household. Figure 11 shows consumers hardly buy refurbished electronics. This might be due to consumer percieve quality of refurbished products is not good and alos availability of free financing options when you buy new products. Figure 12 reveals consumers are not much interested in upgrading their current electronics. Main reason might be availability of new electronics products at affordable prices.

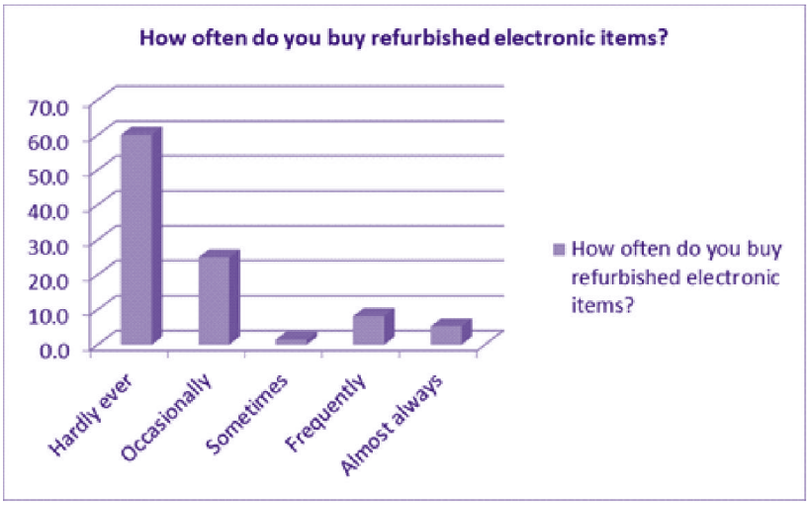


Figure 11: Frequency of buying refurbished products

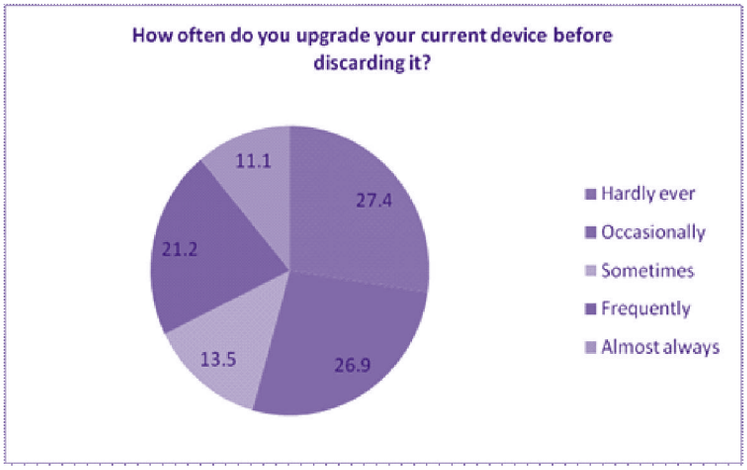


Figure 12: Frequency of upgrading current electronic products

Section F comprises of questions related to importance of various factors impacting E-waste disposal practices. Figure 13 indicates Data Security is one of the most important factor impacting electronics disposal, as electronic products like personal computers and mobile phones contain personal and critical data.

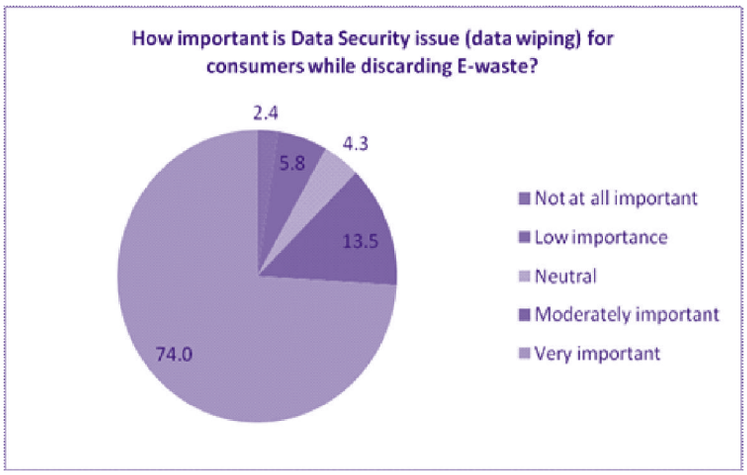


Figure 13: Importance of Data Security in influencing E-waste disposal

Analysis reveals that around 76% respondents consider that convenience or ease of discarding electronics as one of the major factor in impacting E-waste disposal. Figure 14 shows 61% respondents reveals that salvage value of their E-waste is major driver in influencing their E-waste disposal. In India, local kabadiwallas offer more salvage value than formal players. Hence, formal sector players should provide better salvage value for E-waste.

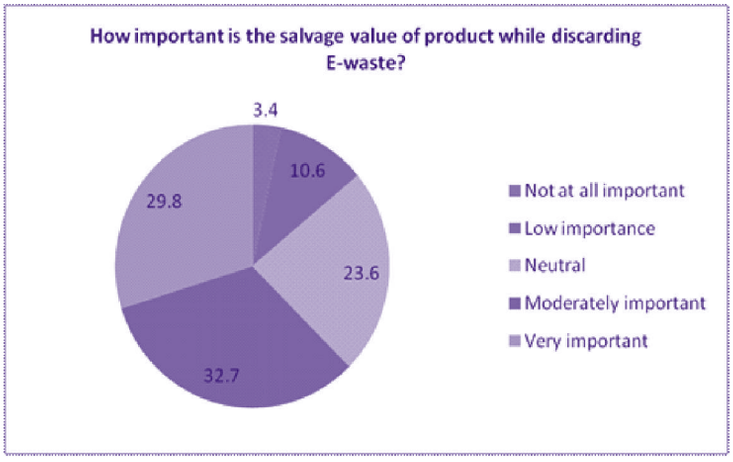


Figure 14: Importance of salvage value in influencing E-waste disposal

Section G proposes alternatives for collection of E-waste and advertisement options to increase awareness among consumers. Figure 15 shows that consumers opine that door step pick up for used electronics is not much effective. According to Figure 16, Figure 17, and Figure 18, placing collection bins in locality and corporate offices, colleges, and conducting collection drives can be effective way for E-waste collection.

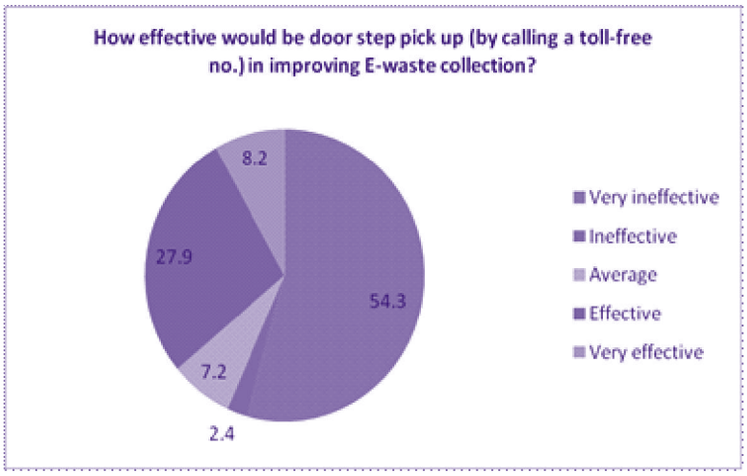


Figure 15: Effectiveness of door step pick up for improving E-waste collection

Figure 16: Effectiveness of collection bins for improving E-waste collection

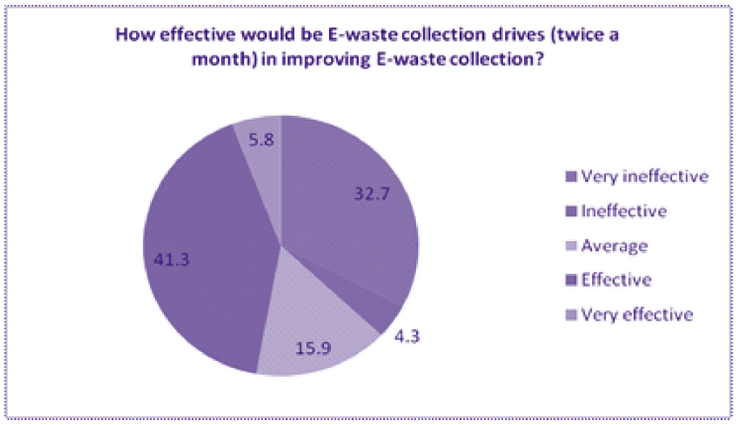


Figure 17: Effectiveness of collection drives for improving E-waste collection

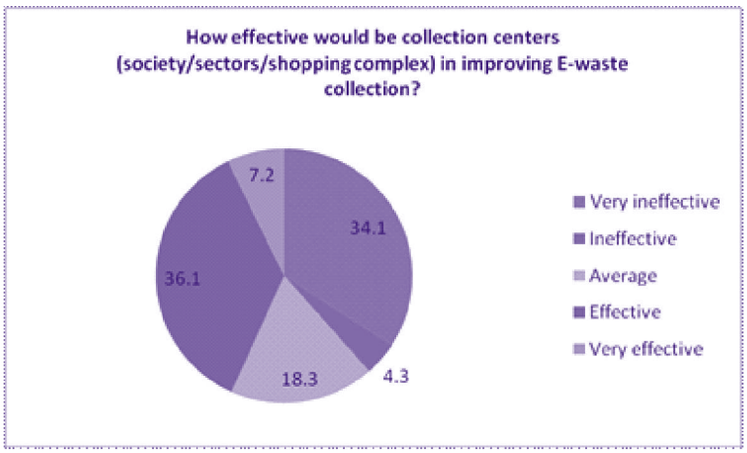


Figure 18: Effectiveness of collection centres for improving E-waste collection

According to Figure 19, e-platform (e.g.: websites like Olx.in, Snapdeal.com, Flipkart.com) can also contribute in improving E-waste collection. Online shopping has become a way of life for most of the Indians. Indian online market is estimated to grow 3.5 times to touch 175 million by 2020 (statista, 2017). Hence, e-tailers can be an effective way for collecting E-waste as well.

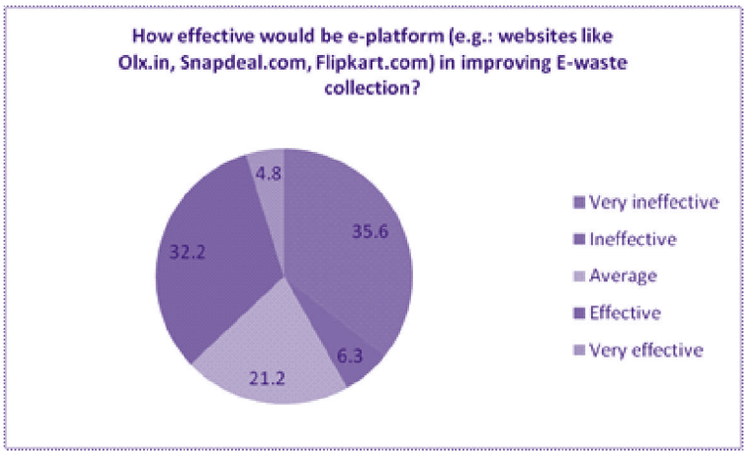


Figure 19: Effectiveness of e-platform for improving E-waste collection

Figure 20 indicates around 49% respondents agree that using electronic media can be a good way to increase awareness.

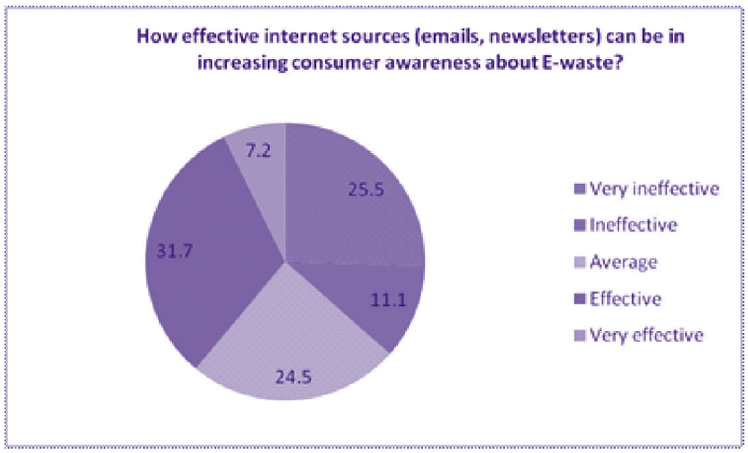


Figure 20: Effectiveness of internet in increasing E-waste awareness

Approximately 47% feel that mass media i.e. Newspaper, TV, Radio can be effective in increasing awareness. Approximately 51% respondents say hoardings and awareness campaigns can be effective way of increasing consumer awareness

respectively. 43% of respondents opined that awareness campaigns are effective way to spread awareness about the e-waste.

Table 2 shows descriptive statistics i.e. mean values and standard deviation of Questionnaire responses. Respondents are not much aware about E-waste management. Most of them think incentives are major driving force in improving collection efficiency. Broken electronics and availability of new products, etc. are reasons for discarding products. Convenience and salvage value of products are major factors impacting E-waste disposal. Hoardings and E-waste campaigns can be effective ways of increasing E-waste awareness among consumers.

Table 2: Descriptive analysis of Questionnaire responses

Descriptive Statistics				
Questions	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
How would you rate your personal awareness on E-waste?	1	5	2.96	1.081
How aware are you about hazardous nature of E-waste?	1	5	2.93	1.090
How aware are you about environmental impacts of E-waste improper disposal?	1	5	3.02	1.101
How would you rate your knowledge on E-waste regulations?	1	5	2.20	1.083
How aware are you of E-waste recycling?	1	5	2.42	1.139
Incentives paid by organized E-waste recyclers are very less	1	5	3.50	.822
Monetary value offered by unorganized players is for E-waste is reasonable	1	5	2.87	.974
Does poor incentives offered by organized players lead to E-waste disposal through unorganized sector (Kabadiwallas)?	1	5	3.63	.999
Product obsolescence is the mainreason of discarding electronics	1	5	3.71	.909
Availability of new products at affordable price is the main reason of discarding electronics	1	5	3.60	1.072
Broken electronics is the main reason of discarding electronics	1	5	3.70	1.016
Craving for new versions is the main reason of discarding electronics	1	5	3.55	1.107

Competition in peer group is the main reason of discarding electronics	1	5	3.32	1.024
How often do you donate your electronics for reuse?	1	5	1.87	1.077
How often do you sell yourelectronics on internet – on websites like Olx.in, Flipkart.com, etc.?	1	5	1.92	1.035
How often do you sell them on retail shops?	1	5	1.63	.913
How often do you dispose electronics along with household waste?	1	5	2.06	1.124
How often do you store unwanted/obsolete electronics?	1	5	2.51	1.247
How often do you take advantage of exchange offers?	1	5	2.57	1.331
How often do you buy refurbished electronic items?	1	5	1.74	1.164
How often do you upgrade your current device before discarding it?	1	5	2.62	1.371
How important is Data Security issue (data wiping) for consumers while discarding E-waste?	1	5	4.51	.988
How important is convenience while discarding E-waste?	1	5	4.11	1.044
How important is the salvage value of product while discarding E-waste?	1	5	3.75	1.097
How effective would be doorstep pick up (by calling a toll -free no.) in improving E -waste collection?	1	5	2.33	1.539
How effective would be collection bins at nearby areas in improving E-waste collection?	1	5	2.72	1.477
How effective would be E-waste collection drives (twice a month) in improving E-waste collection?	1	5	2.83	1.406
How effective would be collection centers (society/sectors/shopping complex) in improving E-waste collection?	1	5	2.78	1.421
How effective wouldbe e-platform (e.g.: websites like Olx.in, Snapdeal.com, Flipkart.com) in improving E-waste collection?	1	5	2.64	1.372

How effective internet sources (emails, newsletters) can be in increasing consumer awareness about E-waste?	1	5	2.84	1.311
How effective newspapers can be in increasing consumer awareness about E-waste?	1	5	2.86	1.365
How effective TV/Radio can be in increasing consumer awareness about E-waste?	1	5	2.71	1.440
How effective hoardings, billboards can be in increasing consumer awareness about E-waste?	1	5	3.05	1.327
How effective E -waste awareness campaigns/programs can be for consumer awareness about E-waste?	1	5	2.92	1.370

4. INTERPRETATION OF FINDINGS

Findings reveal low level of awareness among people related to E-waste and E-waste rules. Based on mean value of awareness related questions as shown in Table 1, it can be inferred that consumers are not much aware about E-waste. Moreover, it can be inferred that awareness about E-waste rules and recycling is very less. Despite of respondents being well educated, most of them lack knowledge related to environmental and health hazards of E-waste. People lack in-depth awareness on the issue. Creating awareness amongst masses like any other source of pollution is must in this regard. Consumers opine that E-waste campaigns and workshops can be an effective method of increasing awareness.

For increasing collection efficiency use of collection bins, and establishing collection centers can be done. Incentives provided by organized sector players as compared to unorganized sector are too less for motivating consumers for environment friendly disposal. Hence, aproper incentive mechanism should be formulated.

Data security is one of the most important factors for E-waste disposal. Hence, there must be assurance of wiping data from electronic gadgets by organized players to avoid misuse of data.

Analysis reveals most of the respondents agree that convenience of E-waste collection, influence their E-waste disposal behavior. Hence, E-waste collection centers and collection bins can be placed at strategic locations. Easy accessibility of venues and convenience along with incentives (monetary and in-kind) for disposal of E-waste is must for improving E-waste management. Most of the respondents are reluctant to buy refurbished electronics due to quality issues, also a few try to upgrade their electronics before buying new.

5. MANAGERIAL IMPLICATIONS

The problem of E-waste has become an immediate as well as long term concern as its unregulated accumulation and recycling can lead to major environmental problems endangering human health. India is presently fronting thee-waste management problem.

People are still oblivious of hazardous nature of E-waste. First and foremost, thing is to spread awareness. Awareness is the key along with incentives (The Hindu, 2016).Nothing drives people more than money. Good reasonable price should be offered for used electronic goods. Only then, it will be reused. Even people in unorganized sector can be made aware of hazards related to E-waste. Collection is first step towards establishing a Reverse Supply Chain of E-waste. Data analysis using questionnaire provides useful insights for increasing collection efficiency.

Low level of awareness among consumers about the hazards of incorrect E-waste disposal. Formal recyclers require huge investment for reaching out to the customers [(UNFCCC, 2013), (ASSOCHAM, 2014)].

Based on respondents' suggestions Social media like Facebook, Twitter, etc. can be used to increase awareness about the issue. Web portal for E-waste can be very helpful.

There must be policies to give tax rebate on the value of electronics you have recycled via proper channel. Like in most of European countries the stores charges separately for the plastic bottles from consumers, to motivate them to return back the bottles and get back amount paid earlier. Similar concept can be implemented for E-waste.

There must be focus on 5 R's to improve E-waste management, which are as follows:

1. Recognize - It means the user (individual/ organization) should recognize that if they no longer need a device, there is no use to store it unnecessary. Therefore, user should sort out necessary from unnecessary.

2. Reduce - It means reducing your consumption or buying less. People should improve their purchasing habits i.e. they should not buy products, which are of less use and they should also upgrade their existing products.

3. Refurbish – Refurbishing the devices with very minor and little defects which can be cleaned, polished, repaired and sold to customers (Morris, 2010).

4. Reuse –Products, which are obsolete for us might be useful to others. They can be given to our relatives or can also be donated to weaker section directly or through NGOs.

5. Recycle –Recycling is essential to use the materials again in manufacturing new products. There must be policies for manufacturers to use recycled materials.

6. Manufacturers should also focus on building environment friendly products or electronics products with modular designs that can be easily upgraded. Hence, electronics device should be customizable/upgradable. Company should provide the features in mobile to increase the RAM, internal Memory, and Camera so that people do not buy product frequently. There must be educational awareness campaigns about hazardous effects of not disposing E waste in an environment friendly way and what effects it has on the eco system. Take-back program by product manufacturers and buyback and trade-in programs are necessary to support circular economy.

Considering the widespread social media addiction, it could be an interesting route to making people aware of how to discard E-waste. Not wordy articles, but smartly done posters and, if possible, getting opinion leaders on social media to talk about the subject may also prompt a more discerning attitude towards the issue. It is required that every store either online or offline should start a program, that at the time of selling any electronics product with its usage manual, they should inform customer about its disposal as well as how inappropriate disposal harms environment. There should be a proper basic electronics disposal system. Many a times, aware consumers dispose their E-waste in an informal way due to lack of Electronics disposal system. Advertisement in the form of video or audio on TV/Radio and newspaper would be fair enough to make consumer aware about E-waste and its mediums to dispose off. Awareness process should start from the school to make children aware and this would become a continuous process. Hence, there is need to come together and rise to the enormous task of spreading mass awareness about E-waste and its hazards.

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